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PENSOFT

Diatrypella heveae Senwanna, Phookamsak & K.D. Hyde (Diatrypaceae, Xylariales): a new record for the Neotropics

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Abstract
During an expedition to the Raso da Catarina Ecological Station, state of Bahia, Brazil, we collected litter samples from *Syagrus coronata* (Mart.) Becc. containing fungal stroma. The material was morphologically identified as belonging to *Diatrypella heveae* Senwanna, Phookamsak & K.D. Hyde (Diatrypaceae, Xylariales); its known geographic distribution was then limited to Thailand. *Diatrypella heveae* was originally described on *Hevea brasiliensis* L. and *Brahea armata* S. Watson in the Chiang Rai Province, Wiang Chiang Rung District, Thailand. We report here the first occurrence of *D. heveae* in the Neotropics, as well as a new host, *S. coronata*, a palm tree endemic to the Brazilian semiarid region.

Keywords
Pezizomycotina, semiarid, Sordariomycetes, taxonomy

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Introduction

Species of the fungal family Diatrypaceae are cosmopolitan, with predominantly saprobe habits, although some taxa are endophytic or plant parasites (Acero et al. 2004; de Errasti et al. 2014). Diatrypaceous ascomycetes are distributed among 20 genera and approximately 1700 currently accepted taxa (Index Fungorum 2020; Wijayawardene et al. 2020).

Diatrypella (Ces. & De Not.) De Not. belongs to the family Diatrypaceae, order Xylariales, and class Sordariomycetes (Acero et al. 2004; Almeida et al. 2016). The genus was introduced by Cesati and De Notaris in 1863, with *Diatrypella verruciformis* (Ehrh.) Nitschke as the type species, to accommodate stromatic members of Sphaeriales (Rao 1964), it currently comprises 146 records (Index Fungorum 2020). *Diatrypella verruciformis* is characterized by conical or truncated ascostromata, pulvinate or discoidal, generally delimited by black lines on host tissues, and perithecia ascoma with ostiole umbilicate or sulcate, asci multisporic, cylindrical, with long pedicels, and ascospores ovoid or allantoid, hyaline or light-yellow (Vasilyeva and Stephenson 2005; Mehrabi et al. 2015; Shang et al. 2017). Several species of *Diatrypella* have been documented in Brazil, including: *Diatrypella aspera* (Fr.) Nitschke, *D. inflata*

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Rick, *D. discoidea* Cooke & Peck, *D. orgaoensis* Henn., *D. irregularis* (Cooke & Ellis) Sacc. (SpeciesLink 2020); *D. frostii* Peck (Vieira et al. 2012); *D. amorae* Viégas, *D. exigua* G. Winter (Mendes and Urben, 2020); *D. caatingae* D.A.C. Almeida, Gusmão & A.N. Mill., *D. flava* D.A.C. Almeida, Gusmão & A.N. Mill (Almeida et al. 2016); *D. persicae* Rick, and *D. caryotae* R.K. Verma (Fortes 2016; Santos 2017).

Diatrypella heveae was described by Senwanna, Phookamsak and Hyde (2017) and was on decomposing branches of *Hevea brasiliensis* (Willd. ex A.Juss.) Müll.Arg. (Euphorbiaceae), popularly known as rubber trees, in Chiang Rai Province, Wiang Chiang Rung District, Thailand. Its main morphological characteristics are as follows: stromata black, rounded to irregular on the host surface, erumpent, solitary to gregarious; pseudoparenchymatous cells white, with a fine black powder on the pseudoparenchymatous tissue around the white entostroma, carbonaceous; perithecial ascomata black, grouped, immersed to semi-immersed in the ascostroma, ovoid to subglobose, 4 or 5 locules, glabrous, ostioles non prominent, with or without papilla; hamathecium with paraphyses dense, filamentous, hyaline, septate, not ramified, thinning toward the apex, incorporated within a hyaline gelatinous matrix; asci polysporous, unitunicate, walls thin, clavate to cylindrical-clavate, long-pedicelate, apically rounded to truncate with subapical ring J-; ascospores initially hyaline, becoming pale yellowish to pale brown at maturity, oblong to allantoid, aseptate, slightly curved, with smooth-walled (Senwanna et al. 2017).

The species was encountered colonizing decomposing rachides of *Syagrus coronata* (Mart.) Becc., a palm tree common in dryland Caatinga forest in Bahia and at the Raso da Catarina Ecological Station (Estação Ecológica Raso da Catarina) (Fig. 1), one of five conservation areas in the Raso da Catarina ecoregion. The regional climate is hot and semiarid, with limited and irregular rainfall, and long periods of drought (mean annual precipitation 300–500 mm) (Paes and Dias 2008). Despite its adverse climatic conditions, the region is of significant biological importance within the Caatinga domain, with considerable species richness and endemism, and a rare and threatened fauna and flora (Velloso et al. 2002).

Syagrus coronata is endemic to northeastern Brazil, with a marked preference for the arid regions of the Caatinga domain (Noblick 1986). The species is of significant importance to the subsistence economy of the region, with essentially all of its parts being useful for craft, industrial, or ornamental purposes; the seeds have high nutritive value, and those palms are considered "life-saving trees" (Drumond 2007). In addition to its socio-economic importance, *S. coronata* has significant ecological relevance, as its fruits are the main food source for the macaw *Anodorhynchus leari* Bonaparte 1858, an endemic and highly threatened bird in the Raso da Catarina ecoregion (Rocha 2005). We report here a new occurrence of *D. heveae*, with a description and illustrations of the species.

Methods

Samples of the decomposing rachides of *Syagrus coronata* were collected in February 2019 at the Raso da Catarina Ecological Station (09°39′04″S, 038°29′08″W), Bahia, Brazil (Fig. 2). The botanical material collected was cut into fragments, and then held in paper bags for transport to the laboratory. Fragments of the fungal structures were separated using a fine-pointed needle, mounted on slides with coverslips, using lactophenol cotton blue to evidence hyaline structures; 5% Melzer to diagnose amyloid reactions at the apices of the asci; water; and 10% potassium hydroxide (KOH) to dilute proteins. We also prepared freehand vertical sections of the ascomata to observe the reproductive structures using a razor blade. Photomicrographs were taken using a digital camera coupled to a Zeiss Primo Star microscope; 30 structures were measured.

The specimen was analyzed in laboratory at the Universidade Federal de Pernambuco, Recife, and in the Mycology laboratory of the Universidade do Estado da

Figure 1. Raso da Catarina Ecological Station **A.** Collection area; photo by Souza VMF. **B.** *Syagrus coronata* (Mart.) Becc.

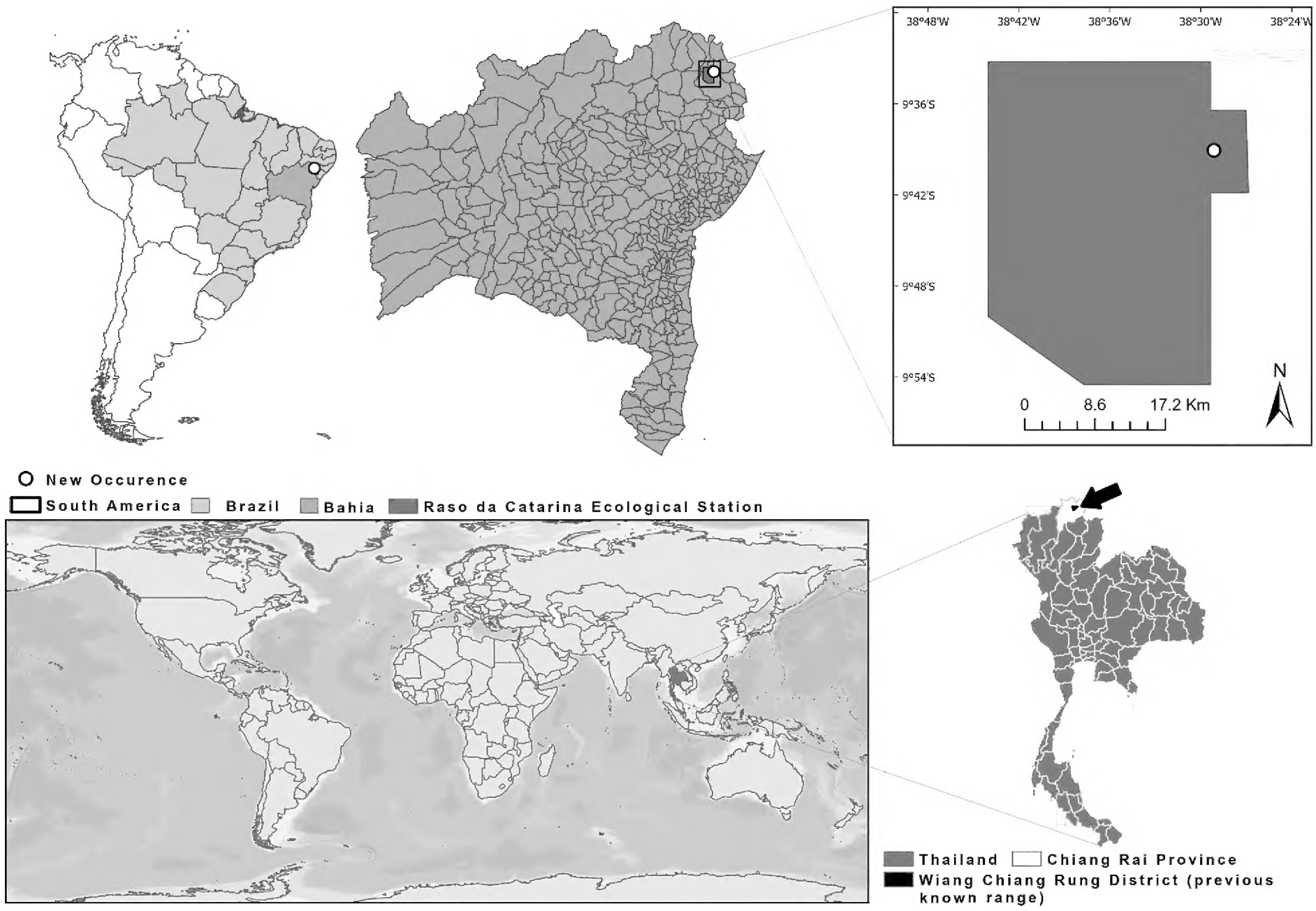

Figure 2. Geographic distribution of *Diatrypella heveae*, and locality of its new occurrence.

Bahia (UNEB), Campus VIII, Paulo Afonso. The fungus was identified based on the morphology of its reproductive structures (stromata, perithecia, asci, and ascospores), consulting the specialized literature (Acero et al. 2004; Almeida et al. 2016; Senwanna et al. 2017; Shang et al. 2017; Konta et al. 2020). A representative specimen is deposited in the collection of MICOLAB UNEB VIII, Laboratório de Micologia: Coleção Didática, Herbário de Fungos e Coleção de Cultura de Fungos.

Results

***Diatrypella heveae* Senwanna, Phookamsak & K.D. Hyde, in Senwanna, Phookamsak, Doilom, Hyde & Cheewangkoon, 2017**; Mycosphere 8 (10): 1846.
(Senwanna et al. 2017)
Figure 3A–F

Material examined. BRAZIL• Bahia, Jeremoabo, Estação Ecológica Raso da Catarina, 09°39′04″S, 038°29′08″W, 584 m elev.; on rachis in decomposition of *Syagrus coronata*; 07 Feb. 2019; Maiara Araújo Lima dos Santos leg.; MICOLAB UNEB VIII 0226.

Identification. Saprobic on the rachis of *Syagrus coronata*. Sexual morph: stromata solitary to gregarious, erumpent in the bark, black, pustulate, with 1 or 2 ascomata. Ascomata 250–400 × 200 µm, immersed in the stroma, subglobose to irregular; ostioles individual, with short necks. Peridium 25–30 µm thick, with two layers, outer layer with thin-walled cells, arranged in textura angularis, brown, inner layer with thick-walled cells of textura angularis, hyaline. Hamathecium 2.5–4 µm wide, filiform, longer than the asci, septate, hyaline paraphyses unbranched. Asci 80–95 × 10–12.5 µm, apically rounded, with a J- apical ring, polysporous, unitunicate, clavate, with a moderately short pedicel. Ascospores 5–9 × 1–2 µm, overlapping, yellowish to brown, ellipsoidal to cylindrical or elongate-allantoid, aseptate, smooth-walled. Asexual morph: unknown.

Discussion

The specimen studied showed morphological characters similar to *Diatrypella heveae*, as described by Senwanna et al. (2017). *Diatrypella heveae* (MICOLAB UNEB VIII 0226) demonstrates morphological characteristics similar to *D. atlantica* D.A.C. Almeida, Gusmão & A.N. Mill. and *D. tectonae* Doilom, Q.J. Shang & K.D. Hyde, although the external layer of the entostroma of *D. tectonae* is black, while that layer of *D. heveae* is white; they differ also in terms of the sizes of the asci (120–150 × 15.5–21.5 µm in *D. tectonae* vs 80–95 × 10–12.5 µm in *D. heveae*) (Senwanna et al. 2017). Yellow dust can be observed in the pseudoparenchymatous tissue surrounding the white entostroma of *D. atlantica*, which is not seen in *D. heveae*. Both of those species, as well as that described here, were encountered in decomposing substrates: *D. tectonae* on dead branches of *Tectona grandis*

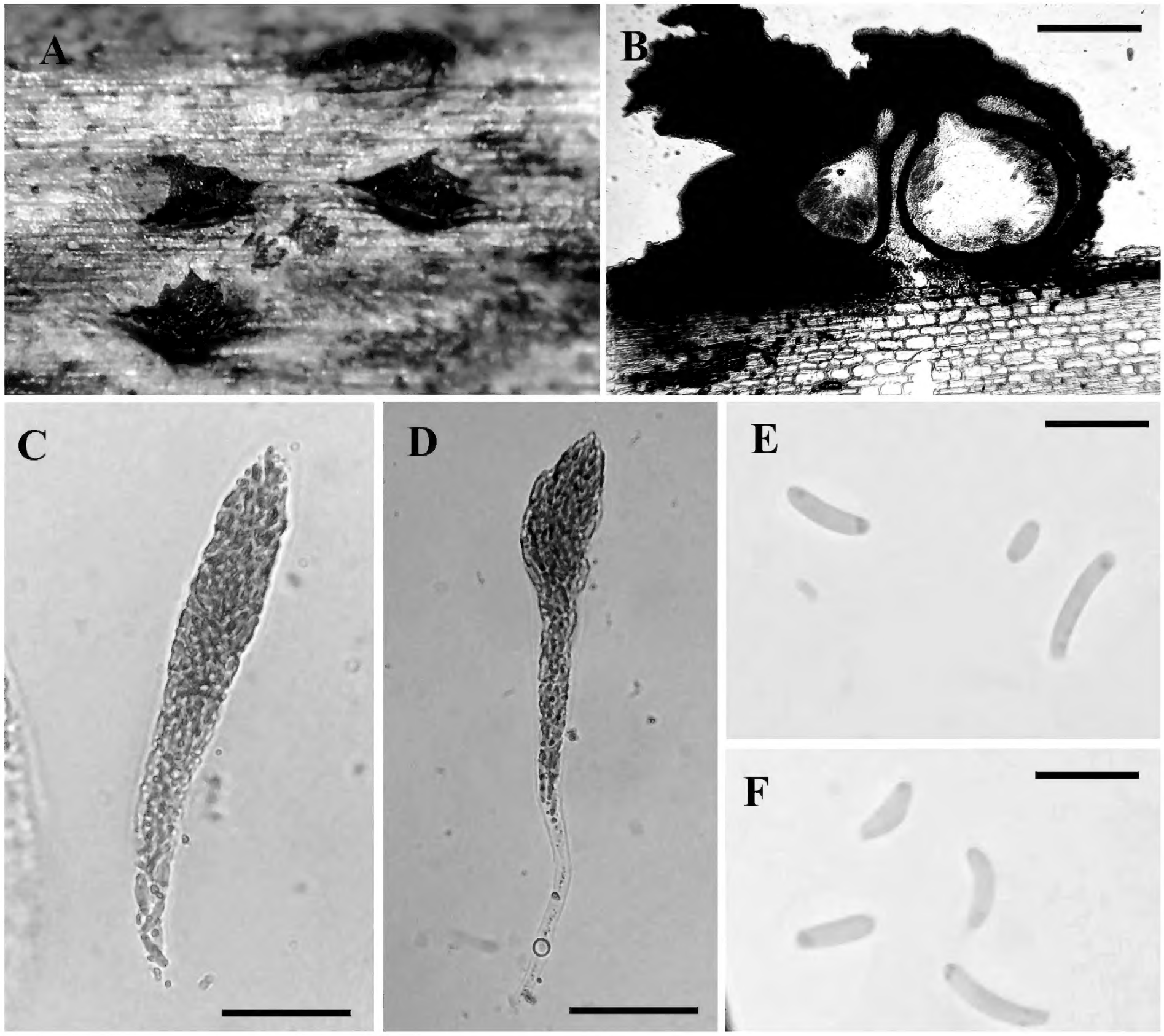

Figure 3. *Diatrypella heveae* MICOLAB UNEB VIII 0226. **A.** Appearance of the stromata on the host surface. **B.** Vertical section of the ascomata. **C, D.** Asci. **E, F.** Ascospores. Scale bars: B = 250 µm; C, D = 220 µm; E, F = 10 µm.

Linn. in Thailand, and *D. atlantica* on the branches of an unidentified plant in Ceará state, Brazil.

The known geographic distribution of *D. heveae* was previously limited to Thailand, where it was encountered on decomposing branches of *H. brasiliensis* and *Brahea armata* S. Watson (Arecaceae) (Konta et al. 2020). *Hevea brasiliensis* is native to the Amazon region (Miranda et al. 2018), and *D. heveae* is probably of Brazilian origin and was introduced into Thailand together with rubber plants. This is therefore the second geographic record of this species, but found colonizing a new host, *Syagrus coronata* (Arecaceae), a species endemic to the semiarid region of Brazil and having high socioeconomic and biological importance, much as rubber trees. Other species of *Diatrypella* (*D. persicae* and *D. caryotae*) have been reported in Brazil associated with *S. coronata* (Fortes 2016; Santos 2017) (Table 1).

We report here the first record of *D. heveae* for the Neotropics, on a new botanical host, and increases of our knowledge of the occurrence and geographic distribution of the species. It is hoped that this discovery will stimulate the search for new hosts and emphasize the necessity of developing conservation strategies for fungal species and their hosts in areas that have been poorly studied, such as the Raso da Catarina Ecological Station in the Caatinga forest of Brazil. This study will contribute to increase the knowledge of the mycota existent in this region.

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Table 1. Morphological comparison of *Diatrypella* species found on *Syagrus coronata*.

Reproductive structures	Fortes 2016 (*D. caryotae*)	Santos 2017 (*D. persicae*)	This study (*D. heveae*)
Stromata	Immersed in the host tissue, becoming eruptive, pyramidal, black, sub-carbonaceous, with 3–6 ascomata	Prorumpent in the substrate, shell carbonaceous, breaking the crust into 3 or 4 separate parts	Solitary to gregarious, erumpent in the bark, black, pustulate, with 1 or 2 ascomata
Ascomata	Subglobose to piriform, with central ostioles, peripheral, individualized; in vertical section 400.0–462.5 × 332.5–405.0 µm	Globose to subglobose, black; in vertical section 395.0–402.5 × 462.5–475.0 µm	Immersed in the stroma, subglobose to irregular; ostioles individual, with short necks; in vertical section 250.0–400.0 × 200.0 µm
Asci	Unitunicate, clavate, stipitate, polysporous; 40.0–65.0 × 10.5–17.5 (–20.0) µm	Polysporous, unitunicate, clavate, with long pedicel; 80.0–107.5 × 12.0–15.0 µm	Apically rounded, with a J- apical ring, polysporous, unitunicate, clavate, with a moderately short pedicel; 80.0–95.0 × 10.0–12.5 µm
Ascospores	Allantoid, slightly curved, sub-hyaline to pale brown, unicellular, smooth; 5.0–7.5 (–10.0) × 2.0–2.5 µm	Allantoid, slightly curved, hyaline to yellow, single-celled, smooth; 12.5–15 × 3–5 µm	Overlapping, yellowish to brown, ellipsoidal to cylindrical or elongate-allantoid, aseptate, smooth-walled; 5.0–9.0 × 1.0–2.0 µm

Conservação da Biodiversidade for their support during collections at the Estação Ecológica do Raso da Catarina.

Authors' Contributions

MALS collected the material; MALS, NSV, RJVO, and JLB prepared the text; MALS and JLB identified the species.

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